

KNOWLEDGE, BEHAVIORS, AND ATTITUDES ABOUT HEARING LOSS AND HEARING PROTECTION AMONG RACIAL/ETHNICALLY DIVERSE YOUNG ADULTS

Carl Crandell, PhD; Terry L. Mills, PhD; and Ricardo Gauthier, AuD

Gainesville, Florida

Over 11 million individuals exhibit some degree of permanent noise induced hearing loss (NIHL). Despite such data, there remains a paucity of empirical evidence on the knowledge of noise exposure and hearing protection devices (HPDs) for young adults, particularly those of diverse racial/ethnic backgrounds. This lack of research is unfortunate, as prior research suggests that the incidence of NIHL can be reduced through educational programs, such as hearing conservation programs (HCPs). Moreover, research also indicates that such educational programs are more beneficial when developed for specific age and/or ethnic/racial groups. The primary aim of this investigation was to determine the knowledge base of 200 college-aged young adults aged 18–29, concerning the auditory mechanism, NIHL, and the use of HPDs. The second aim of this study was to identify race and ethnicity differences or similarities in knowledge of these areas among African-American and caucasian young adults. Overall, in many instances, a majority of the young adults in our study demonstrated a high degree of knowledge concerning factors associated with exposure to excessive noise and the risk of hearing loss. Yet, the results also revealed significant racial/ethnic differences in knowledge, behaviors, and attitudes about the use of HPDs.

Recent estimates suggest that more than 11 million individuals in the United States exhibit some degree of NIHL.^{1–6} Moreover, 40 million individuals work in environments that contain potentially harmful noise levels,^{4,6} and over 50 million Americans routinely use firearms—a common cause of noise-induced hearing impairment.⁷ A specific hallmark manifestation of NIHL is a permanent decrease in hearing sensitivity from 3,000–6,000 Hz, with a characteristic notch at 4,000 Hz.² Additional effects of exposure to high noise levels include physiological changes in heart rate and blood pressure, decrease in work productivity, and an interference with communication that results from the masking of speech.^{2,8,9}

With these considerations in mind, the purpose of this study was to investigate the knowledge, behaviors, and attitudes of a young-adult population in the United States concerning the factors that contribute to NIHL and the use of hearing protection. Additionally, this study was interested in whether there were racial/ethnic differences or similarities in knowledge of hearing loss and the use of HPDs among African-American and caucasian young adults. (*J Natl Med Assoc.* 2004;96:176–184.)

© 2004. From the Department of Communication Sciences and Disorders (Crandell, Gauthier) and the Department of Sociology (Mills), University of Florida. Send correspondence and reprint requests for *J Natl Med Assoc.* 2004;96:176–184 to: Carl C. Crandell, PhD, University of Florida, 352A Dauer Hall, Gainesville, FL 32611; phone: (352) 392-2041; fax: (352) 846-0243; e-mail: crandell@csl.dsu.edu

Key words: noise-induced hearing loss (NIHL) ♦ ethnic/racial differences ♦ hearing conservation programs ♦ hearing protection devices ♦ health beliefs ♦ model stages of change model

BACKGROUND

As noted above, it is well recognized that excessive

noise levels can deleteriously affect auditory function. Moreover, it has been demonstrated that NIHL compromises an individual's psychosocial and physical health. Specifically, past research has indicated that individuals with NIHL often exhibit reduced psychosocial function, such as increased feelings of isolation, depression, loneliness, anger, fear, frustration, and disappointment.^{11,12} Due to the deleterious physiological, psychological, and physical health effects of excessive noise, it is reasonable to assume that active measures must be taken to prevent individuals from acquiring NIHL. The most common and well-recognized procedure for reducing the incidence of NIHL is through educational programs, such as hearing conservation programs (HCPs).⁶ Hearing conservation programs educate participants on the dangers of high noise levels and potential ways of protecting the auditory system, such as the utilization of hearing protection devices (HPDs).

Unfortunately, to date, there remains a paucity of data concerning HCPs for young adults, particularly young adults of various racial/ethnic backgrounds. This lack of data is of concern for several reasons. First, investigations have demonstrated that young adults and adolescents are at increased risk of developing hearing loss due to exposure to high levels of noise.¹¹⁻¹⁴ Such an increase in hearing loss within this population is presumably due to increased noise levels generated by leisure activities, such as personal stereo systems, music clubs/concerts, and/or car loudspeakers. Second, the young-adult age group is on the verge of entering the labor force. Prior research has demonstrated that job safety decreases as a function of increased noise level and hearing loss across all ages of workers.¹⁵ Third, as stated above, there continues to be a dearth of information regarding ethnic/racial differences in the knowledge of hearing loss and HPDs. This lack of information is of concern since research indicates that such HCPs are more beneficial when specifically developed for specific age and/or ethnic/racial groups.^{4,6}

Recent U.S. Census data indicate that more than 80 million people fall into one minority group or another, reflecting dozens of cultures.¹⁶ Moreover, census data indicates that the caucasian population will increase at a slower rate and will thus become a smaller proportion of the entire U.S. population.¹⁷ Currently in the United States, approximately one in four Americans identifies with a minority group. It is estimated that this ratio will increase to one of three within the next decade. Given the increasing racial/ethnic diversity in the United States, this dearth of information about similarities and/or differences in knowledge, behaviors, and attitudes pertaining to the factors that contribute to NIHL and the various protective devices available to decrease hearing loss, constitutes a major public health concern. Clearly, there is a need for more research on NIHL among young adults, specifically dealing with multicultural issues, which is more representative of the general populace and work population.

THEORETICAL FRAMEWORK

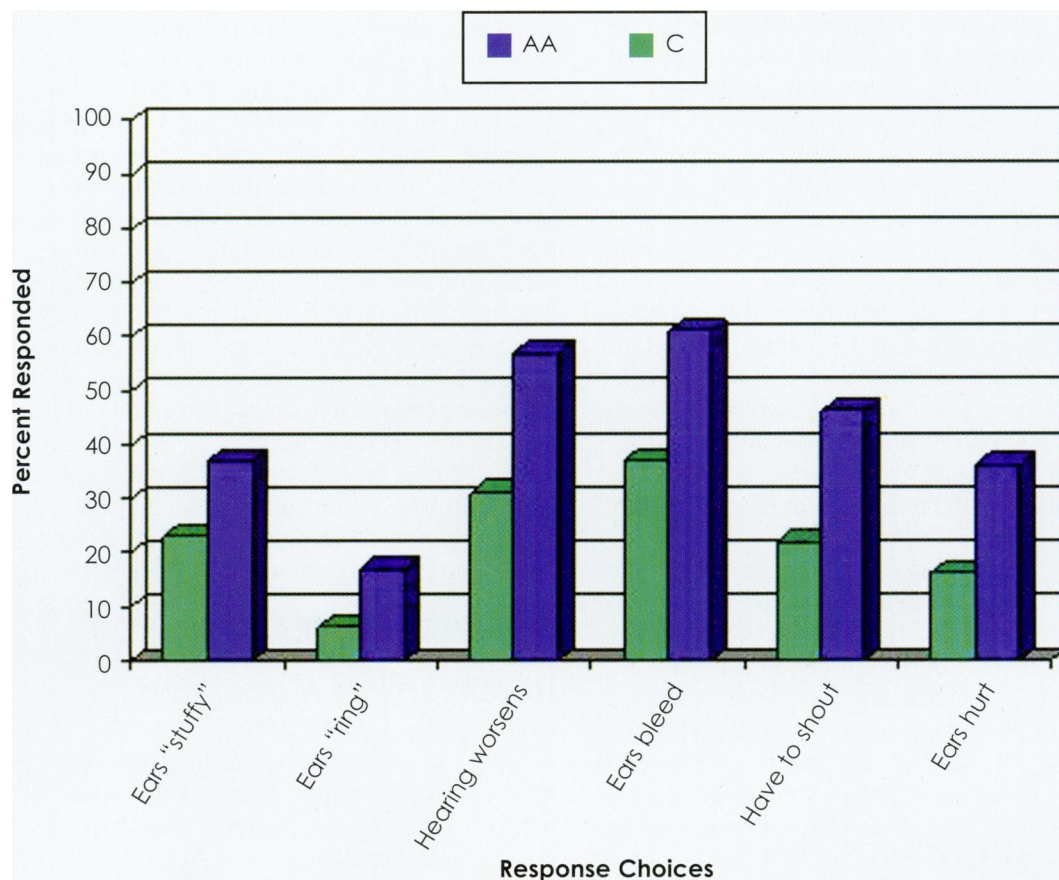
Health Beliefs Model and Stages of Change

The conceptual basis guiding this study incorporates two complementary theoretical frameworks that consider an individual's perceptions concerning a health status, and factors associated with changing one's behavior to accomplish a desired health outcome. The Health Beliefs Model^{18,19} focuses on three beliefs associated with an individual taking some specific health action: 1) perceived vulnerability, which refers to a person's expectancy of being susceptible to a health problem; 2) perceived seriousness is the degree to which a person believes that the health problem will have serious consequences; and 3) perceived benefits—that is, the expectancy that certain behaviors will result in a desired health outcome.²⁰

The Stages of Change Model²¹⁻²⁴ addresses the process of change in which individuals engage to

Table 1. Responses to the Question, "Hearing Loss Caused by Noise"

	African Americans	Caucasians	Total
A. Can be cured by a doctor	6%	3%	4.5%
B. Can be cured by medication	8%	2%	17%
C. Can't be cured	75%	95%	85%
D. Can be cured by bed rest	11%	1%	10%

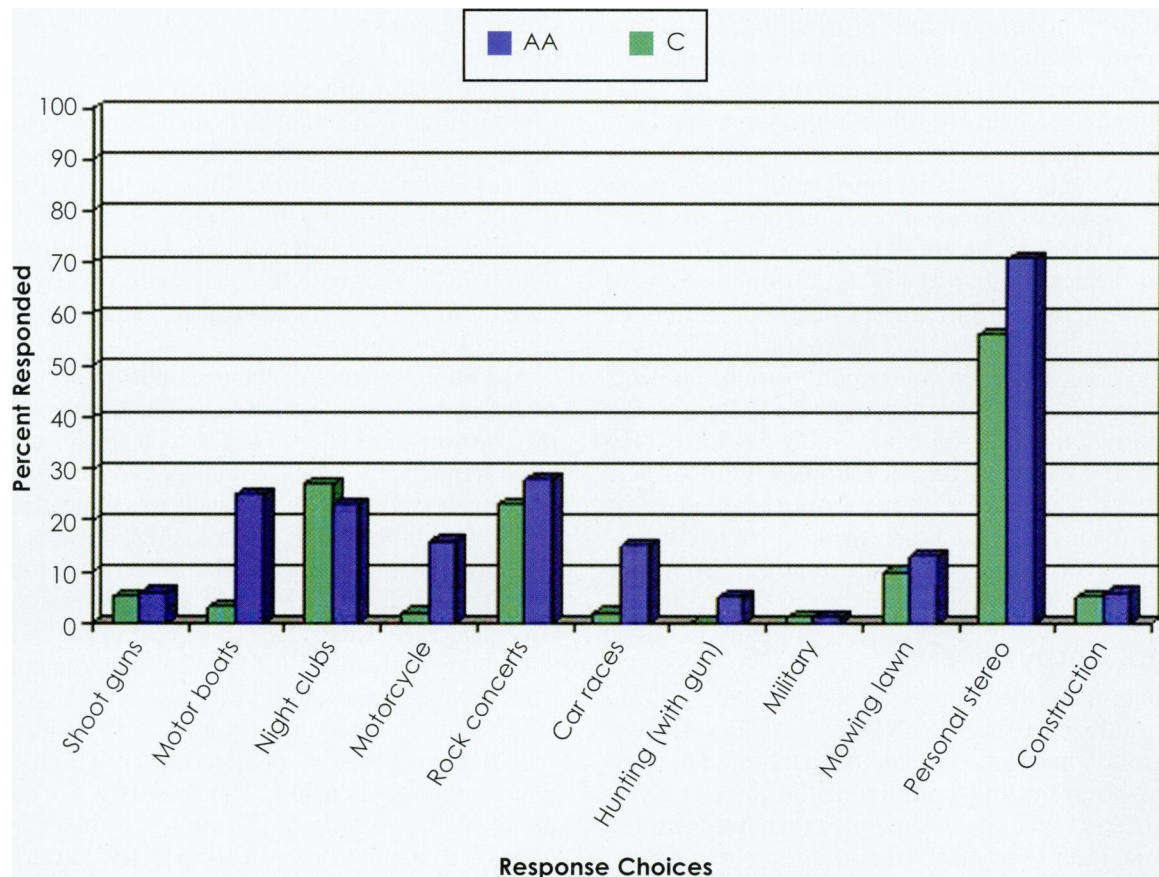
Figure 1. Responses to Question #10: "Which signs indicate when noise is too loud? Circle all that apply."

modify problematic thinking, deficiencies in functioning, problem behaviors, or undesirable effects. Five stages have been associated with the ways in which individuals attempt to change with or without intervention: 1) precontemplation, 2) contemplation, 3) preparation, 4) action, and 5) maintenance.

The precontemplation stage is characterized by the lack of a perceived need or intention for change. Individuals found in this stage may be as resistant to the intervention process as they were before giving in to the pressure from family members, friends, or employers to receive assistance. The contemplation stage is characterized by an individual that is aware of a problem yet has not taken any decisive action or made any commitment to change. Preparation, or decision-making, is characterized by a decision to change as evidenced by taking small behavioral and mental actions necessary for change. The action stage is often charac-

terized by overt behaviors or when the motivation to take action is evidenced over time, effort, and commitment.²⁴ Finally, the maintenance stage is characterized by a continuation of necessary actions that must be met for the desired change to be sustained. Movement through the stages is much like that of a vertical spiral relationship in which progression through the stages of change for a particular problem behavior is relatively forward and sequential (precontemplation → contemplation → preparation → action → maintenance). Progression to a successive stage is largely dependent upon the completion of specific tasks, represented by the stages themselves.²⁵

The power of these complementary models is that for our study, they help to explain the relationship between health beliefs and decisions to adopt preventive health behavior and also the conceptual frameworks provide an indication of the readiness

Figure 2. Responses to Question #11: "Which of these activities do you take part in? Circle all that apply."

of individuals to change poor hearing-related health habits.

METHODS

Subjects

The data come from a convenience sample of college-aged individuals at a major university in the southeastern United States. Because we were interested in comparing racial/ethnic differences between the two largest racial groups in the United States (caucasian and African American), any subject identifying himself or herself as Hispanic, Asian, Pacific Islander, or Other was excluded from the investigation. Subjects consisted of 100 African-American adults (50 males, 50 females) and 100 caucasian adults (50 males, 50 females). The African-American participants ranged in age from 18 to 27 years ($M=22.3$, $SD=1.09$), while

caucasian participants ranged in age from 18 to 29 years ($M=21.6$, $SD=1.14$). Race/ethnicity was self-reported. Study participants were screened to assure that respondents had not taken any coursework or had any prior education in acoustics, hearing loss, noise, or audiology. Any subject who had taken any of the aforementioned coursework was also excluded from this investigation.

Survey Instrument

An 17-item questionnaire was used to measure the knowledge, habits, attitudes, and perception of NIHL and each participant's use of hearing protection. The questionnaire consisted of multiple-choice and fill-in-the-blank format questions. Unfortunately, no appropriate survey instrument was available; therefore, the authors developed the questionnaire. Any question that was considered biased to either racial/ethnic group was removed

from the questionnaire.

The final questionnaire was divided into four sections: 1) demographic information, including age, sex, college major, and prior coursework regarding hearing in noise (questions 1 to 5); 2) knowledge of hearing, the auditory mechanism, and noise induced hearing impairment (questions 6 to 10); 3) subject's habits concerning exposure to noise and use of hearing protection (questions 11 to 12); and 4) attitudes about the use of hearing protection (questions 13 to 17). Questionnaires were distributed by the third author in a wide variety of university courses and took approximately 15 minutes to complete in the classroom setting. Subjects were encouraged to ask questions if any item on the questionnaire was unclear. Subjects were also asked to not discuss any questions with other participants. The third author monitored all participants to ensure that these procedures were followed. No identifying information from the participants was asked for on the questionnaire.

Data Analysis

Data from the answer sheets were entered into and analyzed using SPSS-X statistical software. The individuals who entered the data into the computer program and completed the data analysis were blind to the specific aims of this investigation. The data were summarized as descriptive statistics: means, standard deviations, and percentages. Independent two-tailed, paired comparison t-tests were used to evaluate differences between the two sample populations. A probability level of $p < 0.01$ was used for all analyses.

Results

Due to the large amount of data collected in this investigation, only statistically significant findings between the two ethnic/racial groups are represented in tables and/or figures. Recall that the first section of the questionnaire (questions 1 to 5) obtained demographic information, as previously described. Results from the second section of the questionnaire (questions 6 to 10) sought information on the effects of noise on the auditory mechanism. Specifically, question 6 queried the respondent's knowledge on the anatomical structures of the auditory system that are primarily affected by excessive noise. Overall, 63% of the respondents answered the question correctly (C. The inner ear). African Americans and caucasians answered correctly

(61% and 65%, respectively). Statistical analyses indicated no significant differences between racial group responses on this question ($t = -0.588$, $df = 1,99$; $p = 0.558$).

Table 1 shows the respondent's answer to question number 7 of whether hearing loss caused by noise can typically be cured. Eighty-five percent of the respondents answered this question correctly (C. Cannot typically be cured). A significantly smaller percentage of African-American respondents (75%) answered the question correctly, compared with 95% of the caucasian group ($t = -3.593$, $df = 1,99$; $p = 0.001$).

Question 8 examined the respondent's knowledge on the frequencies at which individuals typically lose their hearing due to noise. The correct answer was "A. High frequencies." Approximately two-thirds (65%) of African-American subjects answered the question correctly, while 51% of caucasian respondents knew the correct answer. Statistical analyses indicated no significant differences between the responses for the two groups ($t = 1.828$, $df = 1,99$; $p = 0.071$). Overall, slightly more than half (58%) of the sample population answered the question correctly.

The next question (question 9) addressed whether there was a specific age at which noise would damage hearing. The majority of respondents (95%) answered this question correctly (D. Noise will damage your hearing at any age.) There was no statistical difference ($t = 1.914$, $df = 1,99$; $p = 0.058$) in group responses, as 92% of the African-American subjects and 98% of the caucasian subjects answered this question correctly.

Figure 1 shows the respondents' answers to the question (question 10) of what symptoms indicated whether a particular noise is excessively loud and potentially damaging. Each of the possible choices are auditory symptoms that can indicate damaging levels of noise. Overall, 42% of respondents checked all of the options on the survey. Statistical analyses indicated significant differences between groups for the following choices: "C. Your hearing seems to get worse for a while but is OK later" ($t = -3.680$, $df = 1,99$; $p = 0.001$), "D. Your ears bleed" ($t = -3.557$, $df = 1,99$; $p = 0.001$), and "F. Your ears hurt because of the noise" ($t = -2.867$, $df = 1,102$; $p = 0.005$). In each of these cases, the caucasian subjects chose the correct answer more often.

The next section of the questionnaire (questions 11 and 12) surveyed the respondent's habits concerning exposure to noise and use of hearing protec-

tion. Figure 2 shows the response to question number 11, "Which of these activities do you take part in?" The respondents were instructed to circle all that apply. It should be noted that previous research suggests that each of these activities can cause NIHL.⁸⁻¹⁰ caucasian subjects participated in potentially hazardous activities significantly more than African Americans, often in several cases: "B. Motor Boating" ($t=-4.895$, $df=1,99$; $p=0.000$), "D. Riding a Motorcycle" ($t=-3.878$, $df=1,99$; $p=0.000$), "F. Car Races" ($t=-3.301$, $df=1,99$; $p=0.001$), and "J. Walkman Radios" ($t=-2.360$, $df=1,99$; $p=0.020$).

Question 12 addressed how often study participants used earplugs when exposed to loud noise. Specifically, respondents were asked to rate the frequency of use of hearing protection in the presence of loud noise. Possible choices were: "A. Always (100% of the time)," "B. Frequently (75% of the time)," "C. Sometimes (50% of the time)," "D. Infrequently (25% of the time)," and "E. Never (0% of the time)." Within each of these choices there were no significant differences in responses between groups. Overall, 72% of subjects indicated that they never wore HPDs when exposed to loud noise.

The final section of the questionnaire queried study participants about their attitudes regarding the use of hearing protection (questions 13 to 17). Figure 3 presents the results to question number 13 addressing why respondents would not or did not wear hearing protection in loud noise. Statistical analyses indicated significant differences between African-American and caucasian respondents in the following answers: "A. Never thought about it" ($t=-3.762$, $df=1,99$; $p=0.012$), "D. Inconvenient to carry around" ($t=2.240$, $df=1,99$; $p=0.027$), "G. Uncomfortable" ($t=-2.408$, $df=1,99$; $p=0.018$), and "H. Forgot to bring/wear" ($t=-2.176$, $df=1,99$; $p=0.032$). For each of these questions, the caucasian subjects were less likely than African Americans to wear HPDs for the aforementioned reasons.

Question 14 asked respondents whether they would consider wearing earplugs if such devices were dispensed free in environments that exhibit high noise levels. For this question, respondents were to circle either "yes" or "no". Overall, 84.5% of the respondents answered, "yes" to this question. African-American subjects answered "yes" 89%, while caucasian subjects answered "yes" 80% of the time. T-tests indicated no significant differences between respondents' answers ($t=1.521$, $df=1,99$; $p=0.131$).

The next question (question 15) addressed whether respondents thought that listening to their favorite music at very loud levels as potentially damaging to their hearing. Respondents were to circle either "yes" or "no". As a whole, 42% of the respondents answered "yes". African-American respondents answered "yes" 38% of the time, while caucasian respondents answered "yes" 45% of the time. These differences were not significant ($t=-0.911$, $df=1,99$; $p=0.365$).

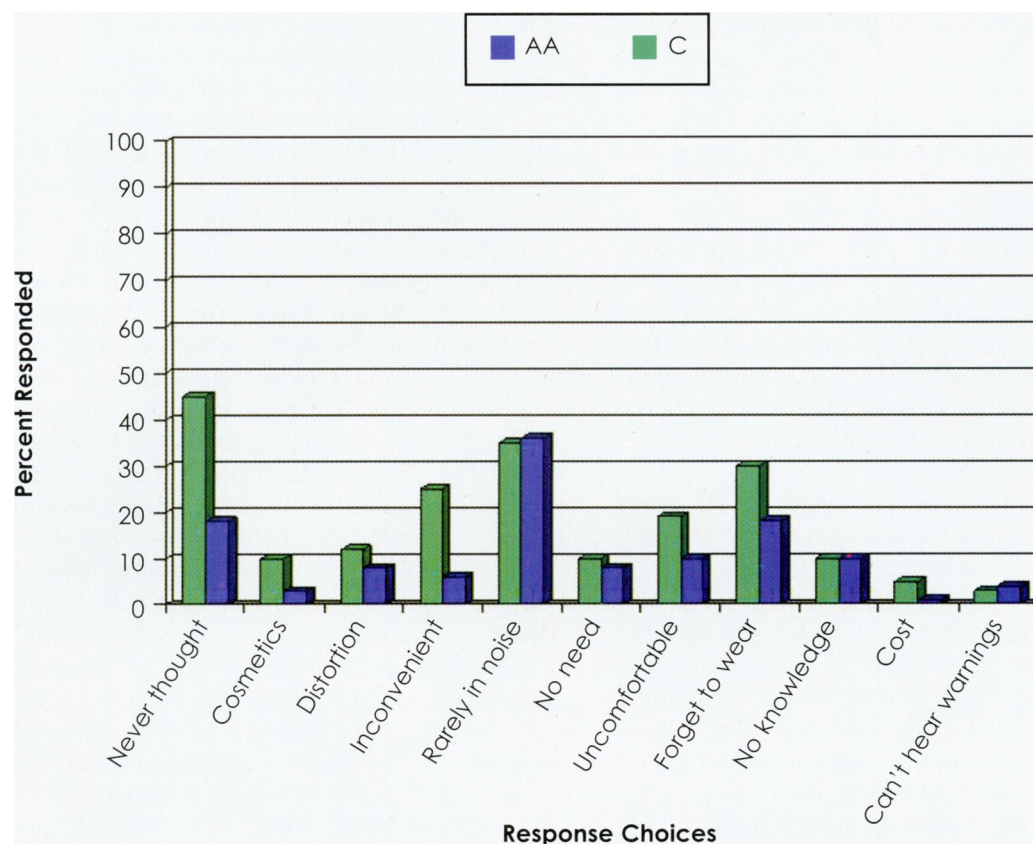
Question 16 asked respondents what was the best way to protect their hearing. Choices were: "A. Earplugs," "B. Earmuffs," or "C. Wearing both earplugs and earmuffs." It is well recognized that the best way to protect hearing is through the synergistic effects of wearing both earplugs and earmuffs. African Americans answered this question correctly 72% of the time, while caucasians responded correctly 68% of the time. No significant differences were noted between groups. ($t=-3.358$, $df=1,99$; $p=0.456$). Overall, 70% of the subjects recognized that the best way to protect hearing was to use both earplugs and earmuffs.

The final question in the survey asked where respondents would purchase hearing protection. This was an open-ended question in which respondents were asked to fill in a blank. Collectively, respondents answered as follows: 41%—Drug store or pharmacy, 13%—Department store, 6%—Hunting/sporting goods store, 3%—Doctor's office, 2%—Music store, 1%—Hardware store, and 34% replied that they did not know. No significant differences were noted between groups. ($t=-6.758$, $df=1,99$; $p=0.786$).

DISCUSSION

Using the Health Beliefs^{18,19} and Stages of Change²¹⁻²⁴ conceptual models, this study examined the level of knowledge, behaviors, and attitudes concerning NIHL and the use of HPD among a young adult population. As noted previously, there remains limited empirical data on these areas for young adults.¹¹⁻¹⁴ Moreover, there is limited data reporting on racial/ethnic similarities or differences in these knowledge bases among African-American and caucasian young adults. Consequently, our study was also interested in identifying the sources of significant variance that were associated with race/ethnicity.^{4,6}

On the whole, results from this investigation indicated that both ethnic/racial groups exhibited considerable knowledge about the effects of noise on the auditory system. For example, a majority of respondents (63%) correctly identified the inner

Figure 3. Responses to Question #13: "Why do you, or would you, not wear ear plugs?"

ear as being most vulnerable to excessive noise. Moreover, 85% of the young adults knew that there is no cure for hearing loss. Additionally, nearly all of the young adults in our study (95%) knew that at any age excessive noise causes damage to hearing.

In general, these overall high-percentage correct scores on some of the most important questions concerning hearing loss are encouraging and suggest that the participants in our study are moving along the stages of change (e.g., precontemplation to contemplation) toward the goal of adopting relevant health promoting behaviors.²¹⁻²⁴ Yet, our findings also provide evidence that there should be concern about educating young adults in general and African Americans in particular about the severity and risk of exposure to excessive noise. For example, although 70% of our study participants correctly indicated that the best way to protect their hearing was to use both earplugs and earmuffs, it is startling to note that 72% of our sample reported that they never wear HPDs.

A plausible explanation for these seemingly contradictory findings may be that among these young adults, the cultural pressures to conform to stylistic norms and youthful images of attractiveness and healthy bodies outweigh the perceived seriousness of damage to their hearing and the perceived benefits^{18,19} of using HPDs. Conversely, because 85% of the study participants reported that they would consider wearing earplugs if the devices were provided free in high-decibel environments, we might also argue that from a public health perspective, if health policy makers have not initiated a more concerted effort to disseminate information to young adults about the risks associated with exposure to excessive noise and have not yet decided that HPDs are important enough to require their use in high-decibel settings, or that establishing upper limits to the decibel output of listening devices is essential to public health, then one could wonder why young adults would consider these HPDs as relevant to their own health? From a conceptual basis, this gen-

**Questionnaire on Knowledge, Behaviors, and Attitudes About Hearing Loss and Hearing Protection
Among Racial/Ethnically Diverse Young Adults**

1. What is your age? _____

2. What is your sex?

Male / Female

3. What is your major in college? _____

4. How many courses have you taken in audiology or a related area (that discussed noise-induced hearing loss)?

- A. No courses
- B. One or several lectures in a course (Indicate approximately how many lectures _____)
- C. 1 course
- D. 2 courses
- E. More than 2 courses

5. What is your ethnic background?

- A. Asian or Pacific Islander
- B. Hispanic
- C. African-American
- D. Caucasian
- E. American Indian or Alaskan Native
- F. Other _____

6. Which part of your ear is primarily hurt by noise?

- A. The outer ear (i.e. auricle and ear canal)
- B. The middle ear (i.e. hammer, anvil, and stirrup)
- C. The inner ear (i.e. cochlea and auditory nerve)
- D. All of the above are equally hurt by noise

7. Hearing loss caused by noise:

- A. Can typically be cured by a doctor
- B. Can typically be cured by medication
- C. Can not typically be cured
- D. Can typically be cured with bed rest

8. At what frequencies (pitches) do individuals typically lose their hearing because of noise?

- A. High frequencies
- B. Low frequencies
- C. Both high and low frequencies are equally affected
- D. Individuals can lose their hearing at any frequency because of noise

9. Noise will generally only damage your hearing if:

- A. You are over 30 years of age
- B. You are over 40 years of age
- C. You are over 60 years of age
- D. Noise will damage your hearing at any age

10. Which signs indicate when noise is too loud? Circle all that apply.

- A. Your ears feel "stuffy" after exposure to the sound
- B. Your ears "ring" or "buzz" after exposure to the sound
- C. Your hearing seems to get worse for a while, but is OK later
- D. Your ears bleed
- E. You have to shout to talk with a friend in that environment
- F. Your ears hurt because of the noise

11. Which of these activities do you take part in? Circle all that apply.

- A. Shooting guns
- B. Motor boating
- C. Nightclubs
- D. Riding a motorcycle
- E. Rock concerts
- F. Car races
- G. Hunting (with a gun)
- H. Military experience
- I. Mowing the lawn
- J. Walkman personal stereos
- K. Construction work

12. Do you wear earplugs when exposed to loud noise?

- A. Always (100% of the time)
- B. Frequently (75% of the time)
- C. Sometimes (50% of the time)
- D. Infrequently (25% of the time)
- E. Never (0% of the time)

13. Why do you, or would you, not wear ear plugs?

- A. Never thought about it
- B. Cosmetics
- C. Distorts sound
- D. Inconvenient to carry around
- E. Don't spend enough time in loud areas
- F. Unnecessary
- G. Uncomfortable
- H. Forget to bring/wear
- I. Limited Knowledge
- J. Cost
- K. Couldn't hear warning signals

14. If earplugs were dispensed at no cost in environments that have high noise levels, would you be more willing to wear them?

- A. Yes
- B. No

15. Listening to my favorite music at very loud levels is potentially harmful to my hearing.

- A. Yes
- B. No

16. The best way to protect my hearing in noisy environments would be to use:

- A. ear plugs
- B. earmuffs
- C. ear plugs and earmuffs

17. Where would you buy hearing protection?

eral lack of action to protect hearing can also be associated with a lack of perceived vulnerability or perceived seriousness.^{18,19}

In considering some of the differences between the African-American and caucasian young adults, our findings showed that African Americans were consistently less likely than their caucasian counterparts to correctly identify symptoms of excessive noise and the risk for hearing damage. However, it is also important to note that African-American young adults were also less likely than their caucasian counterparts to participate in activities that are potentially hazardous to hearing. Among African-American young adults, this dissonance might be attributed to a lack of relevance of hearing-protection information to self-perceptions, goals, or activities.^{26,27} Information about the symptoms of hearing loss may be more likely to produce dissonance until the information is integrated into an individual's self-perception by altering his or her attributions to problems.²⁸

As previously discussed, contemporary cultural images of youthfulness and healthy bodies are often portrayed in popular media and could lead young adults to perceive of using hearing protection as being in the domain of "old age." One indication of the possible implication of popular images of youth may be associated with our finding that only 42% of subjects felt that listening to their favorite music at high levels was potentially damaging to their hearing. Yet it is startling to note that although in general, the majority of the young adults participated in noisy activities, 72% of these subjects never wear hearing protection in potentially damaging environments. Reasons for this lack of use of hearing protection included cosmetic concerns, inconvenience, lack of comfort, and a feeling that such devices are not necessary.

Because the relationship among health beliefs, health behaviors, and readiness to change poor health habits in racial/ethnically diverse groups may differ, it is important to explore how ethnic differences might affect the predictive power of the conceptual framework. If relationships between health beliefs and behaviors are weak or nonexistent, then efforts to modify unsafe health behaviors by modifying health beliefs will probably be unsuccessful.²⁰ Through our study and the use of complementary conceptual frameworks, it is hoped that we have provided a context for how the integration of processes and stages of change in knowledge,

behaviors, and attitudes about hearing loss and hearing protection may aid the process of intervention, thus minimizing the risk of hearing loss in a young-adult population. The integration of process and stages of change were illustrated by interpreting the results of our questionnaire. The importance of such interpretations cannot be overstated. Questionnaire interpretation, or review of items with clients, may be extremely helpful in understanding how clients perceive their problems, themselves, and their relation to the world.²⁹ Social cognition theory suggests that a general test interpretation session with clients is effective as a form of relevant therapeutic conversation and perceptual exploration.³⁰

This exploratory study was intended to evaluate a piece of the overall paradigm concerning the knowledge of NIHL and the use of HPDs. However, our data came from a small convenience sample of college students with similar levels of education, and very little variance in age. Further, the sample was limited to the southeast United States since the respondents were from a major university in this geographic region. As a result, we are cautious in generalizing our findings to all young adults in the United States. We would anticipate greater variance from a large probability sample. Another limitation of the study was that the questionnaire was not a standardized research tool, and it was limited to only 17 items. Clearly, there remain questions concerning the validity and reliability of the questionnaire, since the survey items have not been extensively validated. Yet, our findings are useful in that they help to focus on important racial/ethnic differences that should be further investigated.

These findings have important implications for hearing conservation and education procedures among young adults. First and foremost, greater knowledge about the damaging effects of noise and the utilization of hearing protection needs to be offered to young people. Perhaps such information could be presented in elementary and high school settings so that the incidence of later noise-induced losses of hearing could be decreased. Previous research has demonstrated that such early hearing conservation programs can be very effective in increasing the knowledge of the dangers of noise, and, thus, decreasing the incidence of NIHL. In addition, our data strongly suggest that HCPs need to be developed for various ethnic/racial groups. Although the present study only examined African-American and caucasian populations, a number of

differences in knowledge and practice seem to occur within these demographic groups. Consequently, it is reasonable to expect that additional differences occur in other racial/ethnic groups. Programs for college students and individuals in the industry will need to be developed that take into consideration these differences to obtain maximum compliance from its workers.

CONCLUSION

In addition to continuing to focus on racial/ethnic groups, future research should also focus on gender similarities and differences in order to get a better indication of the variance in attitudes and perception of NIHL across a wide range of demographic characteristics that more accurately reflect the race, ethnic, and gender diversity of the U.S. population of young adults. Future research also needs to investigate young adults of various population strata in diverse geographic regions and also consider the effect of income and age cohort location in hearing conservation, and susceptibility to hazardous noise exposure. For example, this susceptibility may be associated with recreation, where individuals at certain income levels may find themselves involved with particular recreational activities that place them at greater risk for NIHL, or where lower-income individuals have greater risk of working in an occupation in industry where noise exposure is more frequent. Finally, future research should also consider how risk for NIHL is associated with geographic region factors, such as climate and regional culture, including particular recreational activities that may be more popular, such as motor boating or all-terrain vehicle riding.

REFERENCES

1. Alberti PW. Hearing conservation. In: Alberti PW, Ruben RJ, eds. *Otologic Medicine and Surgery*. New York: Churchill Livingstone Press; 1988:1739-1752.
2. Henderson D, Hamernik RP, Dosanjh DS, et al. *Effects of Noise on Hearing*. New York: Raven Press; 1976.
3. International Standards Organization. *Acoustics: Determination of occupational noise exposure and estimation of noise-induced hearing impairment*, ISO-1999. Geneva, Switzerland: International Organization for Standardization; 1990.
4. Melnick W. Industrial hearing conservation. In: Katz J, ed. *Handbook of Clinical Audiology*. Maryland: Williams & Wilkins; 1994:534-552.
5. NIH Consensus Conference Noise and Hearing Loss. *JAMA*. 1990;236:3185-3190.
6. Royster JD. Noise-induced hearing loss. In: Northern J, ed. *Hearing Disorders*. Boston: Allyn & Bacon; 1990:177-188.
7. Kramer WL. Gunfire noise and its effect on hearing. *Hear Ins*. 1990;41:26-28.
8. Miller JD. Effects of noise on people. *J Acous Soc Am*. 1977;56:129-164.
9. Sokas RK, Moussa MA, Gomes J, et al. Noise-induced hearing loss, nationality, and blood pressure. *Amer J Ind Med*. 1995;28:281-288.
10. Wilde G, Humes LE. Application of the articulation index to the speech recognition of normal and impaired listeners wearing hearing protection. *J Acous Soc Am*. 1989;87:1192-1199.
11. Crandell C, Smaldino J. Assistive technologies for the hearing impaired. In: Sandlin R, ed. *Hearing Aid Amplification*. San Diego: Singular Press; 2000:643-672.
12. Crandell C, Smaldino J. Auditory rehabilitation technology and room acoustics. In: Katz J, ed. *New York: Thieme Medical Publishers Handbook of Clinical Audiology*; 2001:642-675.
13. Brookhouser PE, Worthington DW, Kelly WJ. Noise-induced hearing loss in children. *Larynx*. 1992;102:645-655.
14. Lankford JE. Noise pollution awareness needed by the 21st century. *Hear Ins*. 1990;41:6-13.
15. Schmidt JW, Royster LH, Pearson RG. Impact of an industrial hearing conservation program on occupational injuries for males and females. *J Acous Soc Am*. 1980;67(Suppl. 1):S59.
16. US Census. Projections of the Resident Population by Race, Hispanic Origin, and Nativity: Middle Series, 1999 and 2000. Population Projections Program, Population Division, U.S. Census Bureau, Washington, DC. 2000. Online: <http://www.census.gov/population/projections/nation/summary/np-t5-a.txt>.
17. US Census. Census Bureau Projects Doubling of Nation's Population by 2100. U.S. Department of Commerce News. 2000. Online: <http://www.census.gov/Press-Release/www/2000/cb00-05.html>.
18. Rosenstock IM. Why people use health services. *Milbank Fund Quar*. 1966;44:94-127.
19. Becker J. The health belief model and prediction of dietary compliance. *J Health Soc Beh*. 1977;18:348-366.
20. Gochman DS. The organizing role of motivation in health beliefs and intentions. *J Health Soc Beh*. 1972;12:285-293.
21. McConaughy EA, DiClemente CC, Prochaska JO, et al. Stages of change in psychotherapy: a follow-up report. *Psychotherapy: Theory, Res, Prac*. 1989;26:494-503.
22. McConaughy EA, Prochaska JO, Velicer WF. Stages of change in psychotherapy: measurement and sample profiles. *Psychotherapy: Theory, Res, Prac*. 1983;20:368-375.
23. DiClemente CC, Prochaska JO, Fairhurst SK, et al. The process of smoking cessation: an analysis of precontemplation, contemplation, and preparation stages of change. *J Consult Clin Psych*. 1991;59:295-304.
24. Petrocelli JV. Processes and stages of change: counseling with the transtheoretical model of change. *J Couns Dev*. 2002;80:22-30.
25. Prochaska JO, DiClemente CC, Norcross JC. In search of how people change: applications to addictive behaviors. *Amer Psych*. 1992;47:1102-1114.
26. Mandler G. *Mind and body: psychology of emotion and stress*. New York: Norton Press; 1984.
27. Pezdek K, Whetstone T, Reynolds K, et al. Memory for real-world scenes: The role of consistency with schema expectation. *J Exp Psych: Learn, Mem, Cogn*. 1989;15:587-595.

28. Martin J. The construction and understanding of psychotherapeutic change: conversations, memories, and theories. New York: Teachers College Press, Columbia University; 1994.

29. Goldman L. Using Tests in Counseling (2nd ed.). Santa Monica, CA: Goodyear Press; 1971.

30. Martin J, Prupas L, Sugarman, J. Test interpretation as the social-cognitive construction of therapeutic change. In: Lichtenberg JW, Goodyear RK, eds. Scientist-Practitioner Perspectives On Test Interpretation. Boston: Allyn & Bacon. 1998:132-150.

We Welcome Your Comments

The *Journal of the National Medical Association* welcomes your Letters to the Editor about articles that appear in the JNMA or issues relevant to minority healthcare.

Address correspondence to ktaylor@nmanet.org.

CAREER OPPORTUNITIES

The Harvard Medical School Research Fellowship Program in COMPLEMENTARY AND INTEGRATIVE MEDICAL THERAPIES

The Division for Research and Education in Complementary and Integrative Medical Therapies at Harvard Medical School invite candidates to apply for a two-year, NIH funded research fellowship to begin July 1, 2005. This joint teaching program of Harvard affiliated teaching hospitals offers candidates the opportunity to obtain an M.P.H. degree, as well as clinical and teaching experiences in internal medicine, complementary / alternative medicine (CAM) and integrative medicine. Candidates must be BC/BE in internal medicine by the beginning of the fellowship. Deadline for applications is March 31, 2004.

For information and application forms, contact:
Ms. Patricia Wilkinson
Harvard Medical School
Division for Research and Education in Complementary and Integrative Medical Therapies
401 Park Drive, Suite 22A West
Boston, MA 02215
Email: patricia_wilkinson@hms.harvard.edu

The participating institutions are equal opportunity employers. Underrepresented minority candidates are encouraged to apply.

Neuroradiologist

The Department of Radiology at Beth Israel Deaconess Medical Center (BIDMC), Harvard Medical School, is seeking applicants for a faculty position in Neuroradiology. Responsibilities include clinical service; teaching of medical students, residents, and fellows; and research in Neuroradiology. The Department has five whole body GE and Siemens MRI systems (Two 3-T, Three 1.5T). One of the 3T systems is dedicated to research. There is a small bore high field imaging and spectroscopy research system as well. There are seven multislice CT instruments (a mixture of 16, 8, and 4 slice units). Angiography is performed in a bi-plane digital room. There are ample research opportunities with excellent support in technique development, MR spectroscopy, perfusion imaging, and image processing. Candidates for this position must have board certification in diagnostic radiology, have or be eligible for CAQ in neuroradiology, and be eligible for licensure in the state of Massachusetts. Salary and academic rank will be commensurate with experience and qualifications. Interested applicants should send curriculum vitae to David B. Hackney, MD, Chief of Neuroradiology, Professor of Radiology, Harvard Medical School, Department of Radiology, Beth Israel Hospital, 330 Brookline Ave., Shapiro 4th Floor, Boston, MA 02215 (617) 667-2552; fax (617) 667-8212; e-mail dhackney@bidmc.harvard.edu.

Beth Israel Deaconess Medical Center is an EEO/AA employer.
Visit our website at <http://radiology.bidmc.harvard.edu>